(12) UK Patent Application (19) GB (11) 2 041 463 A

(21) Application No 7943497
(22) Date of filing
18 Dec 1979
(30) Priority data
(31) 3625
(32) 20 Dec 1978
(33) Italy (IT)
(43) Application published
10 Sep 1980
(51) INT CL³ F16J 15/34
(52) Domestic classification
F2B 13C1 13C2D
13C2E4 13C2F5
13C2F6
(56) Documents cited
GB 830062
(58) Field of search
F2B
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(54) Bearing seals

(57) The invention relates to a device for sealing the lateral heads of conveyor rollers, each of the lateral heads comprising: a bearing assembly 4, the inner part 4*a* of which is integral with the shaft of the roller, and the outer part 4*b* with the rotatable surface 2 of the roller; a lateral head locking bush 6 that has a sloping section 6*c* turned towards the bearing; a shoulder 8 belonging to and rotatably united with the outer part of the bearing, essentially of "L" section; and an annular gasket of toroidal shape, made of elastic material, disposed between and bearing on the facing surfaces of the bush and the shoulder in a stretched condition. In a modification (Fig. 7) the gasket bears against a radial face on the bush and an inclined end of the shoulder 8. The cross section of the gasket may be circular, elliptical, triangular or square.

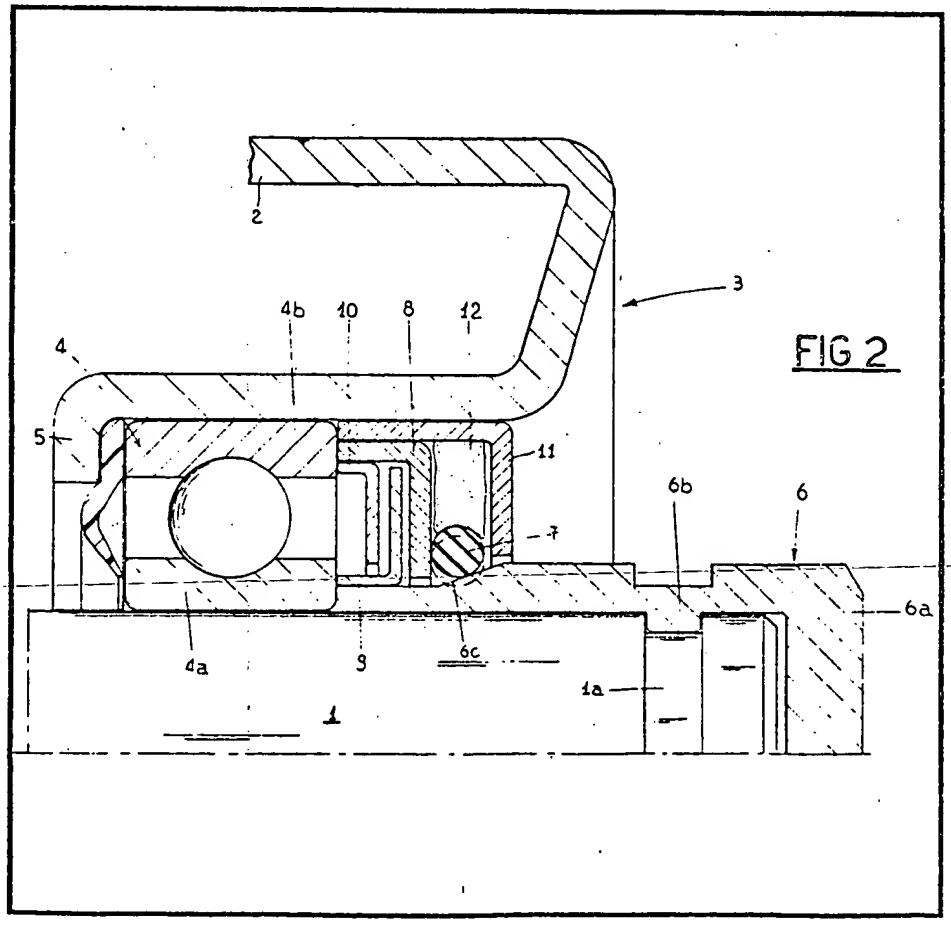

FIG 2

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SPECIFICATION

A device for sealing lateral heads of conveyor rollers

This invention relates to a device for sealing, in particular, the lateral heads of conveyor rollers.

As is knonw, in conveyor rollers of the fixed shaft type, the bearings that are placed in the region of the lateral heads have to be suitably protected, using gaskets and special labyrinth seals, in order to prevent lubricant from overspilling out of the bearings and, at the same time, extraneous elements, such as powder, water and similar, from entering therein.

The present way in which the seal is achieved is by using rubber annular gaskets, or similar, of various polygonal sections, that are mounted on the shaft of the rollers, close to the bearings and to the labyrinth seals with which the lateral heads are provided.

For example, extensive use is made of annular gaskets with an inward pointing section whereby a wedge shaped lip is formed, and this is closely attached to the shaft of the rollers. The said gaskets are destined to rotate together with the rollers and although they do create a seal in a radial direction, they are subjected to rather heavy wear in the inside part that is closely attached to the shaft of the rollers, and thus the seal deteriorates after a given period of operation. In order to achieve a greater sealing action, use is sometimes made of garter springs inserted in corresponding housings provided in the annular gaskets, and this causes the aforementioned wedge shaped lip to be attached even more closely to the fixed shaft.

This particular method has, however, also not given fully satisfactory results since it brings about an increase in friction and, therefore, causes the gasket to wear still more.

Another problem that arises with the sealing system is that the surface of the shafts has to be always given adequate grinding treatment, at least in the area where the gaskets are fitted, and this involves costs that are heavy.

Use is also made of another type of annular gasket of a substantially "V" section in which a lateral lip is closely attached to a surface perpendicular to the axis of the roller, the lip being defined by a thin plate rotatable with the roller, so as to create an axial seal, the gasket itself being fixed around the fixed shaft.

With the latter type of gasket, there is, however, the problem of the seal not being long lasting since it is dependent solely on the lateral lip being closely attached to the corresponding rotatable part through the elasticity, in an axial direction, of the lip and, therefore, of it being inefficient.

In practice, "V" section gaskets do not, despite the advantage of not requiring the shafts to be ground, provide a reliable seal once a relatively short period of operation has elapsed, nor are they suitable for rollers which operate under adverse ambient conditions in, for example, dusty areas, or which convey powdery materials in, for example, mines, quarries and salt mines.

The main object of the present invention is to overcome the difficulties outlined above in respect of the known systems for sealing conveyor rollers, through the creation of a device for sealing the lateral heads of the types of rollers, by means of which a particularly long lasting, efficient, sealing action is achieved, with wear reduced to a minimum, and without it being necessary to grind the support shafts.

Another important object of the invention is to make available a sealing device, the cost of which is low because of the use of gaskets of a very simple construction.

A further object still of the invention is to make available a sealing device that can be fitted easily and quickly to the lateral heads of conveyor rollers of any type and size.

According to the invention, a device for sealing, in particular the lateral heads of conveyor rollers, each of the lateral heads comprising a bearing, the inner part of which is integral with the fixed shaft of the roller, and the outer part of which is integral with the rotatable cylindrical surface of the roller, comprises: a bush coaxial to the shaft and integral with it or fixed thereto in a position such as to be placed towards the outside of the lateral head of the roller, at the side of the inner part of the bearing; a rotatable shoulder attached to the outer part of the bearing that extends, at least in part, in the direction of the shaft, the surfaces which face the bush and the rotatable shoulder, respectively, being inclined one with respect to the other and convergent in the direction of the shaft; and an annular gasket made of elastomer, or at any rate of an elastic material, substantially toroidal in shape, place between the surfaces which face the bush and the rotatable shoulder, respectively, the section of which, once the lateral heads of the roller have been fitted on, is closely attached to both of the surfaces and expanded with respect to its normal condition, the force of adhesion being dependent upon the distance at which the surfaces are spaced apart and their inclination.

In one preferred form of embodiment, the bush has, in the region of the lateral surfaces thereof, a truncated cone section that tapers towards the bearing and is suitable for sealing use with an annular elastomer gasket substantially toroidal in shape, the initial inside diameter of which is slightly less than the mean outside diameter of the truncated cone section; a rotatable shoulder, integral with the outer part of the bearing, being provided between the truncated cone section and the

bearing for the annular gasket to rest sealed against, in a substantially axial direction.

An advantage of a device of this nature is that the sealing gasket can be very simple in shape and easy to make.

Furthermore, the device for simultaneously closely attaching the gasket to the shoulder and to the truncated cone section of the bush is such that the seal is excellent, with wear reduced to a minimum, even after a long period of operation.

Moreover, the device according to the invention does not require the shaft of the rollers to be ground, since the gasket does not exercise any action on it.

The surfaces on which the gasket operates can be easily and economically fixed in the most suitable way.

An appropriate variation in the taper value of the truncated cone section of the bush makes it possible to vary the diametrical expansion of the annular gasket and thus the elastic circumferential expansion, as well as the ratios of the radial and axial forces and thereby allow the pressure rises and drops caused by changes in the temperature of the air inside the roller, known as "surge phenomena", that is to say, the incoming and outgoing of more or less humid air inevitably passing through the bearing, to be resisted.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is an axial section of the device according to the invention, fitted to a conveyor roller;

Figure 2 is an enlarged part axial section of the device shown in Fig. 1;

Figure 3 is an axial section of a further embodiment of the device shown in Fig. 1, fitted to a conveyor roller;

Figures 4, 5 and 6 show partial sectional views of three different gasket sections which can be used in the device; and

Figure 7 is an axial section of a further constructional embodiment for the device in question.

Figs. 1, 2 and 3, show a fixed shaft 1 of the roller, a rotatable cylindrical surface 2, and two lateral heads of the said roller 3.

Each of the lateral heads 3 is provided with a ball bearing assembly 4, the inner part 4a of which is fixed coaxially to the shaft 1, whilst the outer part 4b is integral with the said rotatable surface 2 of the roller. The rotatable part 4b is fixed in a recess 5 in the lateral heads 3, integral with the rotatable surface 2.

In the example shown in Figs. 1 and 2, there is a bush 6, made of metal or of a plastics material which has suitable characteristics, and this is designed to enshroud coaxially the furthermost extremity of the shaft 1 and to be fixed thereto in the region of each of the lateral heads 3. The bush 6 has a tail piece 6a which is locked by means of an internal annular projection or upset 6*b* which interlocks with an annular groove 1a, in the shaft 1, as envisaged in Italian Patent No. 983,252 in the name of the same Applicants as herein.

Furthermore, the bush 6 has a section 6c of its lateral surface in the form of a truncated cone, which tapers in a direction towards the bearing 4 and is fitted to the shaft 1 closely attached to the inner part of the said bearing 4.

The aforementioned truncated cone-shaped section 6c, which is located at a certain distance away from the bearing 4, engages with an annular elastic gasket 7 of torodal shape, made of elastomer, rubber or similar material. The latter has to have an initial inside diameter slightly less than the mean outside diameter of the truncated cone section 6c so that, after assembly, it seals against the truncated cone section, as will be explained better hereinafter.

Furthermore, in the assembled construction the annular gasket 7 seals against a shoulder formed by a rotatable annular member 8 which is of "L" section and which is coaxially integral with the outer rotatable part 4b of the bearing 4, in such a way as to constitute a contact surface for the gasket, perpendicular to the axis of the shaft 1. The contact surface is approximately in the region of the termination of the truncated cone section 6c of the bush 6, towards the bearing 4.

The annular member 8 is advantageously constituted by the outer terminal part of a labyrinth seal of a known type, though in the embodiment illustrated in Fig. 2, not only does it provide the member 8 but also two other annular members 9 and 10 of "L" section, fixed coaxially to the bush 6 and to the rotatable part part 4b of the bearing 4, respectively.

In the embodiment illustrated in Fig. 3, in addition to the annular member 8, the labyrinth seal also comprises two cages 17 and 18, preferably made of a plastics material, for example nylon, and constructed so that the metal rotating parts do not come into contact with the shaft 1 even when the roller has deteriorated through wear.

In this way the danger of sparking is avoided, and rollers which have lateral heads with labyrinth seals of this type are particularly suitable, on account of their safety characteristics, for use in surroundings where there are mines or powder mills, etcetera. The bearing is also provided with nylon cages.

A further rotatable annular member 11 of "L" section is coaxially integral with the recess 5 in the lateral heads 3 so as to form, together with the aforementioned annular member 8, an annular chamber in which, besides the gasket 7, grease of a suitable density, or a sponge or piece of felt 12 (Fig.

2) impregnated with lubricant, is housed in order to achieve continuous external lubrication of the gasket 7, in addition to the internal lubrication derived from the bearing lubricant.

The operation of the above described device is as follows.

Once the bearing 4 has been mounted on the fixed shaft 1, the labyrinth seal is assembled, with care being taken to interpose the gasket 7 between the members 8 and 11.

When the sponge or piece of felt 12 is used, it has to be first inserted in between the members 8 and 11, its function being, amongst other things, to hold the gasket 7 in a position coaxial to the labyrinth seal.

When, instead, only grease is utilised for the external lubrication of the gasket 7, the member 11 has its wall 11a shaped so as to provide a rim 11b which, as shown in Fig. 3, partially restrains and guides the gasket 7.

Once the assembly operation has been completed and the labyrinth seal has been arranged in its correct position with respect to the bearing, the bush 6 is mounted on the shaft 1 and thrust threaded on to the member 9, after which it has to be fixed to the shaft 1 through the internal annular projection 6b.

After everything has been suitably placed, the gasket 7 expands (as shown with dashes in Fig. 2), and presses itself elastically against the truncated cone section 6c of the bush 6 to create an efficient seal.

At the same time, the truncated cone section 6c causes the gasket 7 to undergo a displacement in an axial direction, and pushes it against the annular member 8 in such a way as to create there an efficient axial seal.

In other words, the tendency of the elastic gasket 7 to return to its original lesser diameter condition causes the gasket to press and seal against the truncated cone section 6c and the contact surface perpendicular to the axis of the shaft, defined by the rotatable member 8.

Thus a double seal is achieved which very efficiently prevents both the overspilling of the lubricant contained in the bearing 4 and eventually in the corresponding laybrinth seal, and the entry of extraneous bodies, such as powder or water.

The presence of the grease or of the lubricant impregnated sponge 12 in between the annular members 8 and 11, and that of the lubricant coming from the bearing 4, ensures that the gasket 7 is lubricated continuously, and places it in a condition in which it is able to carry out its function perfectly, practically throughout the life span of the bearing 4.

While the cylindrical surface 2 rotates together with the outer part 4b of the bearing 4 and the annular members 8, 10 and 11, the shaft 1 remains fixed along with the inner part 4a of the bearing, the bush 6 and the annular member 9 of the labyrinth seal. The annular gasket 7 can remain immobile with the bush 6 or it can be carried in rotation at a speed less than that of the cylindrical surface 2, depending upon the lubrication conditions and the rotation speed of the roller.

The gasket 7 fulfils its sealing function in a complete and efficient way, whilst the friction thereon is distributed over two annular zones (in the region of the truncated cone section 6c of the annular member 8), thereby rendering the gasket longlasting.

The device described above can be fitted also in embodiments where the provision of a labyrinth seal at the side of the bearing is not foreseen, that is to say, when the use of the annular members 9 and 10 is not envisaged.

In the embodiment shown in Fig. 3, there is a metal or plastics material bush 16, shorter in length than the bush 6 shown in Fig. 1 and 2. The bush 16 is either thrust sealed to the shaft or is bonded thereto. Furthermore, the bush 16 has no tail piece but is maintained in an axial position on the shaft 1 through a locking ring 13.

Everything else in the device depicted in Fig. 3 is practically identical to what has been described above with reference to Figs. 1 and 2. The bush 16 has a truncated cone section 16a, which engages with an elastic packing ring 7 of toroidal shape which also engages with an outer member 8 of the labyrinth seal at the side of the bearing 4, inside the annular cavity defined by the annular member 11.

Insofar as the operation of the device illustrated in Fig. 3 is concerned, the same details as for Figs. 1 and 2 apply.

Figs. 4, 5 and 6 show three possible forms in which the gasket 7 can be made, for example, elliptic, square with rounded off corners, and virtually triangular with arcuate sides and rounded off corners. The shape of the gasket 7 can, however, be selected appropriately to vary the friction or the resistance to rises and/or drops in pressure caused by surge phenomena.

Fig. 7 illustrates a constructional embodiment of the device wherein the annular member 8 has a front wall 8a sloping in such a way as to form a frustrum of a cone, the smaller base of which is projected towards the outside, whilst the bush, shown at 18, has a wall 18a turned towards the annular member 8 perpendicular to the axis of the roller.

Again in this case the same sealing effects as described above are achieved.

As can be seen, the device according to the present invention has a particularly simple and rational structure which is designed to enable there to be a perfect seal in the region of the lateral heads of conveyor rollers and to ensure a considerably long period of operation.

Furthermore, the use, as envisaged according to the invention, of toroidal sealing gaskets ensures costs being low and the gaskets being easily available, whilst the presence of the bush 6, 16 or 18, which can be made of

suitably treated steel or of plastics material which has adequate characteristics, makes the use of non-ground shafts 1 possible.

Alternatively, for example, the bearing 4 can be fixed directly on the bush 6, 16 or 18, as well as onto the shaft 1.

CLAIMS

1. A device for sealing the lateral heads of conveyor rollers, each of the lateral heads comprising a bearing, the inner part of which is integral with the fixed shaft of the roller, and the outer part of which is integral with the rotatable cylindrical surface of the roller, comprising a bush coaxial to the shaft and integral with it or fixed thereto in a position such as to be placed towards the outside of the lateral head of the roller, at the side of the inner part of the bearing; a rotatable shoulder attached to the outer part of the bearing that extends, at least in part, in the direction of the shaft, the facing surfaces of the bush and the rotatable shoulder, respectively, being inclined one with respect to the other and convergent in the direction of the shaft; and an annular gasket made of elastomer, or other elastic material, substantially toroidal in shape, placed between the facing surfaces of the bush and the rotatable shoulder, respectively, the section of which gasket is such as, once the lateral heads of the roller have been fitted on, to engage closely both of the said surfaces and to be expanded with respect to its normal condition, the force of adhesion being dependent upon the distance at which the said surfaces are spaced apart and their inclination.

2. A sealing device according to Claim 1, wherein the bush is a fixed bush which coaxially surrounds the shaft and has, in the region of the lateral surface thereof, a truncated cone section which tapers towards the bearing and the annular gasket has a normal inside diameter slightly less than the mean outside diameter of the truncated cone section; a rotatable shoulder, integral with the outer part of the bearing, being provided between the truncated cone section and the bearing for the annular gasket to rest sealed against, in a substantially axial direction.

3. A device according to either of the preceding claims, wherein the rotabable shoulder is formed by an annular member coaxial to the shaft and having a surface which extends towards the shaft for sealing engagement with the annular gasket.

4. A device according to claim 3, wherein the annular member is "L"-sectioned and forms the outer part of a labyrinth seal placed at the side of the bearing.

5. A device according to claim 3 or 4, wherein the annular gasket is housed in a corresponding annular chamber coaxial to the shaft, designed to contain lubricating means.

6. A device according to claim 5, wherein the annular chamber is defined by the annular member with which the rotatable shoulder is provided and by a further annular member integral with the outer rotatable part of the bearing.

7. A device according to Claim 6, wherein the further annular member is provided with a wall which extends towards the shaft of the roller and has internally an annular rim for partially restraining and centering the gasket.

8. A device according to any of claims 5 to 7, wherein provision is made for a piece of felt or a sponge of circular rim shape which is placed inside the chamber, soaked in lubricant, and which is designed to hold the gasket centred with respect to the axis of the annular chamber.

9. A device according to any of the preceding claims, wherein the surface of the rotatable shoulder which extends towards the shaft of the roller is perpendicular to the roller itself.

10. A device according to any of Claims 1 to 8, wherein the surface of the rotatable shoulder which extends towards the shaft of the roller is a frustum of a cone, the smaller end of which is turned towards the bush.

11. A device according to Claim 10, wherein the surface of the bush which faces the rotatable shoulder is perpendicular to the axis of the roller.

12. A device according to any of the preceding claims, wherein the gasket cross section is in the form of an ellipse.

13. A device according to any of Claims 1 to 10, wherein the gasket cross section is square with rounded off corners.

14. A device according to any of Claims 1 to 10, wherein the gasket cross section is in the form of a triangle with rounded off corners and sides that arch outwards.

15. A sealing device substantially as herein described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1980.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

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FIG1

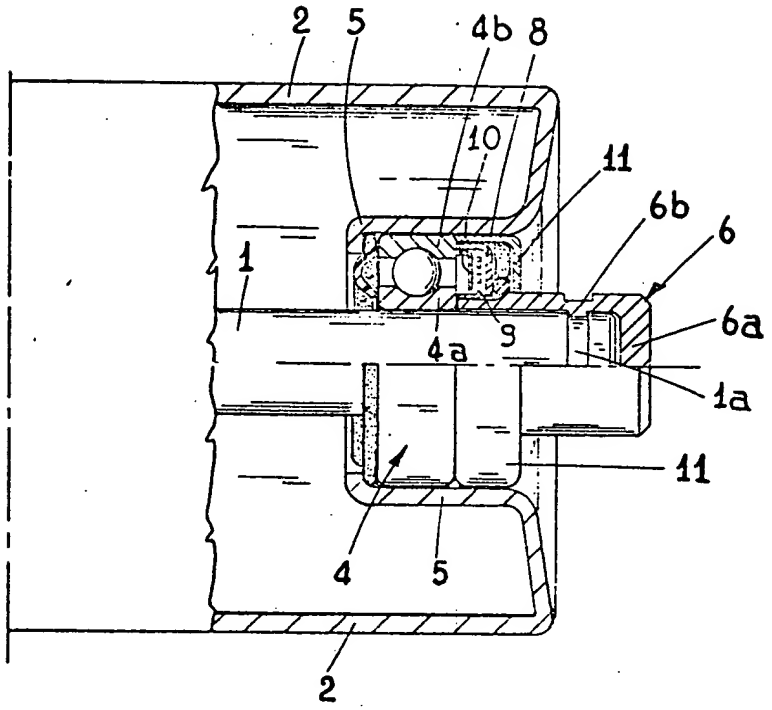

FIG3

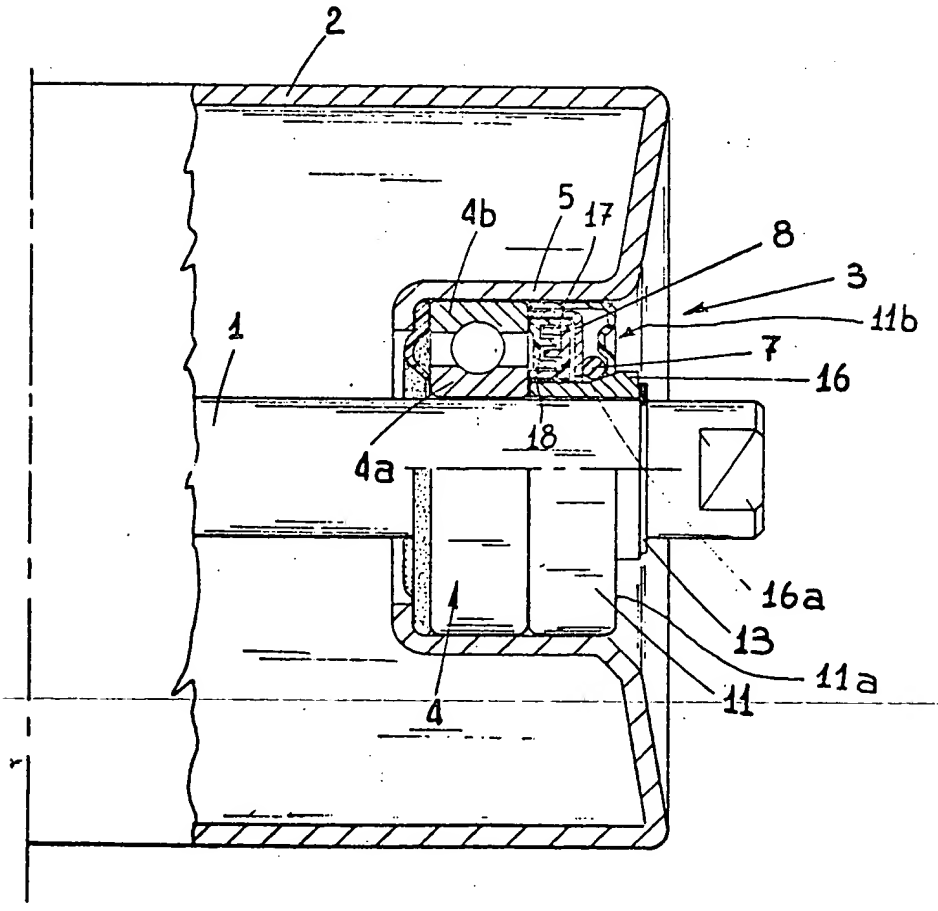

FIG 2

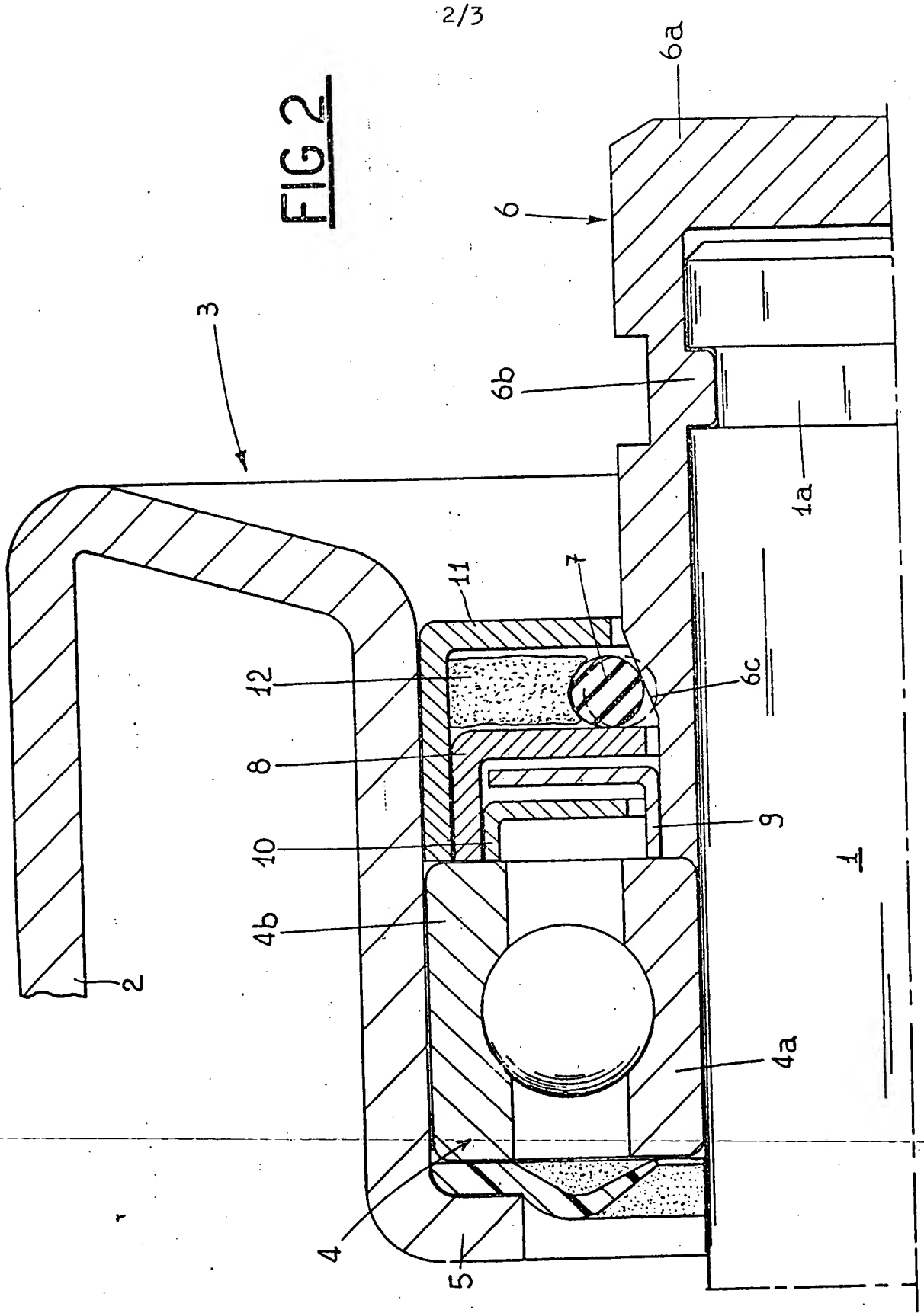

FIG 4

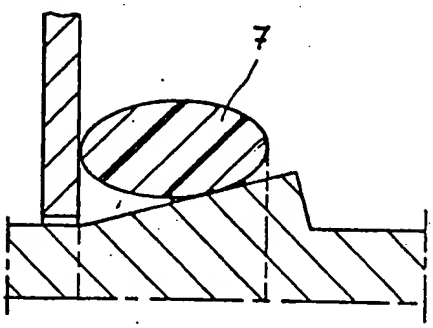

FIG 5

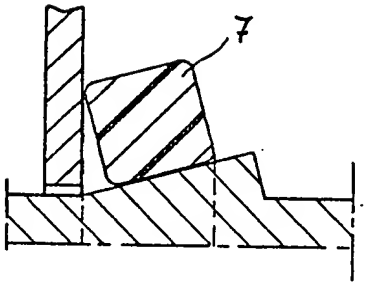

FIG 6

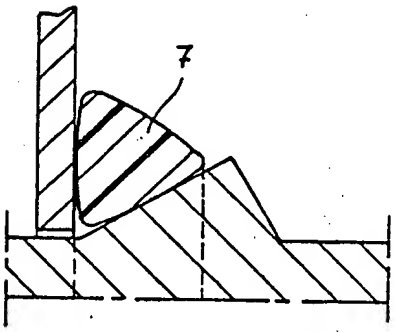

FIG 7